NBC CT Summer 2019 Internship

Jacob Morse

METEO 395A

Introduction and Background

Similar to many other meteorologists, I became fascinated by the weather at a young age as I was growing up in western Connecticut, especially during the winter season when strong nor'easters would strike New England, sometimes blanketing the entire landscape with over a foot of snow. I also remember looking up weather information on my family's computer from a very young age and my hometown was impacted by several extreme weather events throughout my childhood such as Superstorm Sandy, Hurricane Irene, the 2011 Halloween Snowstorm, and many others. All of these events and experiences caused me to develop a passion for meteorology and I knew it was something that I wanted to study in college.

However, starting off as a freshman at Penn State, I had no idea of what I wanted to do with the major after I graduated; I just knew that I loved the meteorology classes that I was taking and I had a strong passion for the weather. I tried out several different clubs, organizations, and activities to see which ones I liked the most, but during the fall semester of my sophomore year at Penn State, it became clear to me that I wanted to focus on broadcast meteorology throughout the rest of my college education. I loved doing Campus Weather Service videos, being a part of the Weather or Not show, and helping out behind the scenes with Weather World throughout that semester, and I was also taking METEO 481 (Weather Communications I) during the semester. All of these experiences and learning opportunities both inside and outside of the classroom shaped my career goals to target getting a job as a broadcast meteorologist after graduation.

I knew that many successful broadcast meteorologists had one or more internships at local television stations as they were obtaining their college degree, and I recognized how

valuable it would be to gain real-world experience in a work environment that I could see myself being a part of in a few years. Therefore, I did not want to waste any time and contacted a television station in my home state of Connecticut that I had been watching throughout my childhood, NBC CT, to apply for an internship for the summer after my sophomore year. During the fall semester, I contacted the chief meteorologist at the station, Ryan Hanrahan, who is a Penn State alum, and after several email conversations and a video interview, I got the news that I would be an intern at NBC CT throughout the summer. I was incredibly excited to get the internship underway and begin to learn from professionals in the field about what it was like to be a broadcast meteorologist at a station in a top 35 television market.

Daily Responsibilities of Internship

Throughout my childhood, I had driven past the NBC CT station numerous times and watched countless NBC CT news broadcasts, so I was very excited to finally be able to check out the inside of the station and get the internship started. My first day was incredible as Ryan invited me to sit in on the severe weather workshop that he was hosting, where meteorologists from the National Weather Service offices in the area and broadcast meteorologists from other NBC owned and operated stations in the Northeast were gathering at NBC CT to discuss severe weather forecasting and communication before the summertime. I learned a whole bunch about the meteorological factors that contribute to severe weather, especially in New England, and what the "game plan" is for a television station when a severe thunderstorm warning or a tornado warning is issued. This workshop was very interesting and I got to meet some of the best and brightest meteorologists in the Northeast on my first day!

Throughout the rest of the summer, I stuck to coming into the station two to three times per week usually during the afternoons and evenings. When I got to the station, usually around noon, I would update their forecast spreadsheet with the current temperature forecasts that a couple of the most reliable models were outputting for the two cities that NBC CT primarily forecasts for: Hartford (inland) and New Haven (shoreline). Ryan made the point that some stations have begun to eliminate this step of forecasting from the process, and that they just let the computer output a certain number without meteorologists having to spend some extra time on the forecasting component. But I think that comparing different models still has some value, even as computers get better and better at predicting the weather, since there can be small errors or specific trends that only a human forecaster can pick up on. I also thought it

was neat that I use a similar method of collecting data from a variety of models in a spreadsheet and then use my intuition along with the model's guidance to create forecasts for my Campus Weather Service forecasting shifts, so I enjoyed doing this part of the internship. During the afternoon, I would also update NBC CT's website with the latest forecast and I even got to write a few web articles for them throughout the summer. Most of the website articles that I wrote included many images from the WSI MAX graphics system, painting the picture for the reader of what the forecast looked like. It was really interesting to see how their website editor worked and how weather headlines fit in with all of the other news stories that were happening that day. Each day I would also add the closed captioning for all of the weathercasts that the meteorologist had during the evening shows, and this was done through the iNews program. I found this program really interesting to learn how to use, since this is where the entire newscast is built by the producer. It includes all of the camera positions for the robot cameras, the times that each story is taken, the teleprompter scripts for the news anchors, and much more. I sometimes liked to follow along in iNews during the newscast to see what was coming up next and where the weather segments were being placed in relation to some of the other news stories. I also learned a lot by listening in on some of the meetings that the producers of the different newscasts had with the meteorologists about how important the weather was on each day, and therefore where their weather segments would be inserted into the show. This also determined how long they would need for each of their weather hits and what kind of teases they would want relating to their forecast, so that everything flowed seamlessly together when the cameras started rolling.

I spent most of my time at NBC CT over the summer working with their WSI MAX graphics system by creating new graphics that I came up with and updating existing graphics that they already had. This was something that I really enjoyed doing, since I consider myself a fairly creative person and I had plenty of ideas throughout the summer of good graphics that some of the meteorologists actually ended up using on-air. I learned a lot about creating graphics, not only through my own experimentation, but also by asking questions to the other meteorologists and by looking at some of the details of the graphics that were already built. Many of the graphics that I made appeared on-air due to their relevance for that day's weather or because it was a unique graphic that NBC CT did not already have. I have included some of my favorite graphics that I created during the internship at the end of this section. All of the knowledge that I gained about the WSI MAX graphics system is very valuable for me moving forward with the Campus Weather Service at Penn State as well as for when I get a job at a local television station, since many of them use the WSI MAX graphics system. I was also able to share many of the graphics that I created on social media, especially on Twitter, where the meteorologists at NBC CT could share the post to reach a much larger audience.

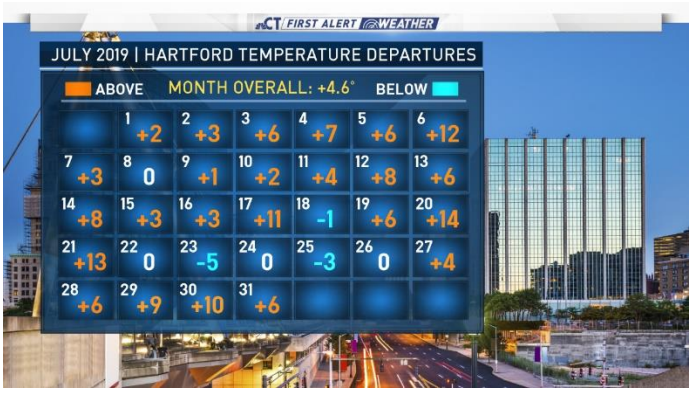
Additionally, I was able to come into the station on a few Saturdays throughout the summer, where there are not as many people working and it's a more laid-back atmosphere. This allowed me to practice at their chroma key several times to get some clips for my weather reel and improve my skills by using the technology and graphics that an actual television station uses. Kaitlyn McGrath and Darren Sweeney, who are a couple of the meteorologists that worked on the weekends when I came in, were also able to give me some feedback and critiques about what I need to work on to get better. This was very helpful to get insights from

meteorologists who have been in the industry for several years about what I was doing well and things I could do to make myself a better broadcast meteorologist in the future. I also came in for the morning show once during the summer to see what some of the differences were compared to the evening news shift, and this was really interesting for me because the way that the weather was presented in the morning is very different compared to the evenings. Primarily, there are many more weather hits that the meteorologist has to do since people are usually watching the morning news for a shorter duration than they are during the evening time. Additionally, the meteorologist has to focus on the present day's weather more in the morning, since people like to plan their day out and they want to know what the weather will be like on that specific day. Therefore, there's less of an emphasis on the forecast for multiple days in the future during the morning newscast. I really enjoyed experiencing both the morning and evening newscasts, and noticing the differences between the two and how the meteorologist has to present their forecast in a different way based on the time of day.

Finally, I was able to take part in some unique experiences throughout the summer that taught me more about the station as a whole and their connection to the community. In June, I attended the Travelers Championship, which is an annual PGA Tour event in Cromwell, CT, with NBC CT where we had a booth in the fan zone. This was really fun to interact with people in the community who came up to our booth to learn more about NBC CT and get some free merchandise. We also had Snow Monster in the fan zone, which is a 4x4 vehicle that the station outfitted with accessories and decorations, for people to check out and take pictures with. Snow Monster is an important part of the NBC CT brand, and they love to use it whenever they can at school visits and events in the community. I also got to sit in on a station meeting that

NBC CT had during the middle of the summer, where some of the executives spoke about what the station had been doing well and areas that needed some improvement. This was really interesting to hear from some of the important decision-makers at the station and how much they value the ratings that their station gets so that they can figure out how to reach more people in the future. Finally, I got to sit next to the producer of the 5pm newscast in the production-control room during one of her shows. I was able to ask her questions about how she puts the show together each day and how the newscast evolves from all the scripts and commands in iNews to a polished product that is put on-air. This was really interesting to see all of the different people, including multiple directors and producers, that it takes to put together a successful newscast, and how these people communicate with the on-air talent before, during, and after the newscast.

All of these responsibilities that I completed each day and all of the extra opportunities that I got to experience both in the studio and outside of it exceeded my expectations for this internship. I thought that Ryan Hanrahan and all of the other meteorologists at the station did a great job of keeping me busy when I was there and taught me so much about what it's like to be a broadcast meteorologist. I not only learned about how these meteorologists choose to present the weather on-air each day and what graphics they decide to use based on the forecast, but also about all of the different responsibilities that they have behind the scenes every day. I think that all of these things that I got to experience over the summer have put me in a better place moving forward with the rest of my college education as well as once the time comes for me to take a job as a broadcast meteorologist. This summer internship exceeded my expectations in every way and I really enjoyed learning from all the meteorologists at NBC CT.


JULY 2019 | HARTFORD TEMPERATURE DEPARTURES
ABOVE
MONTH OVERALL: +4.6°
BELOW
1 +2
2 +3
3 +6
4 +7
5 +6
6 +12
7 +3
8 0
9 +1
10 +2
11 +4
12 +8
13 +6
14 +8
15 +3
16 +3
17 +11
18 -1
19 +6
20 +14
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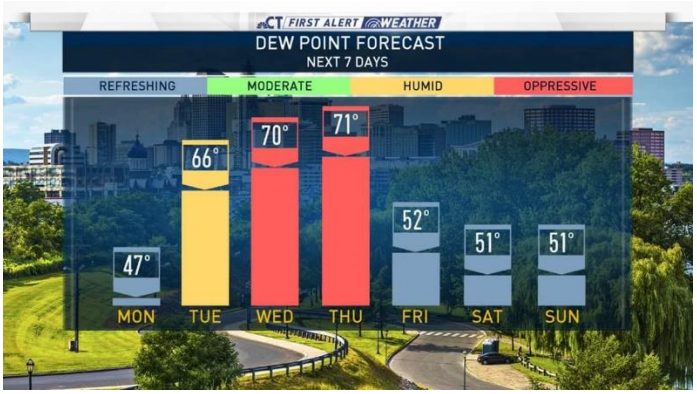
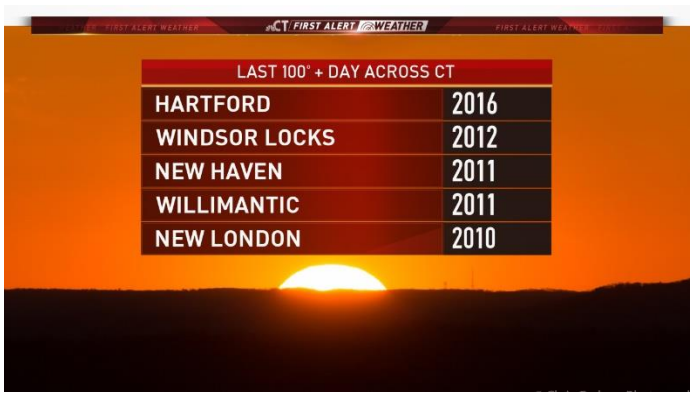
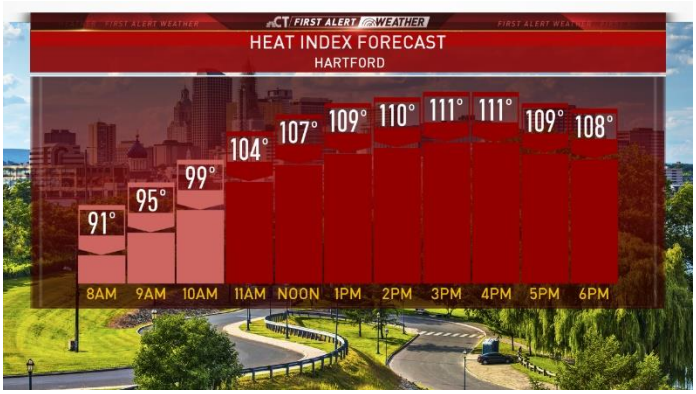
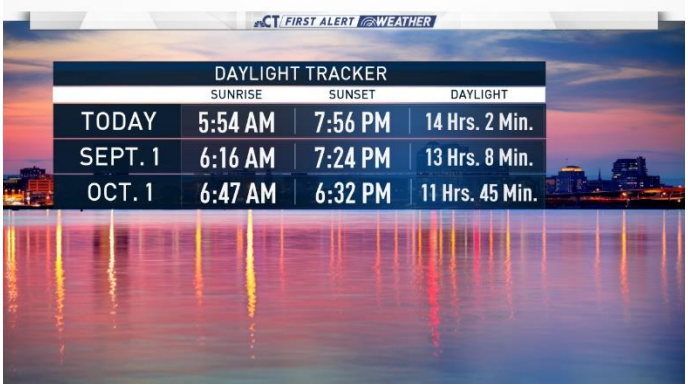
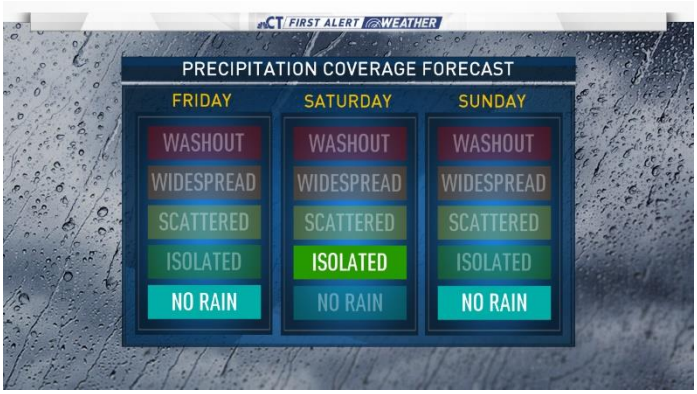
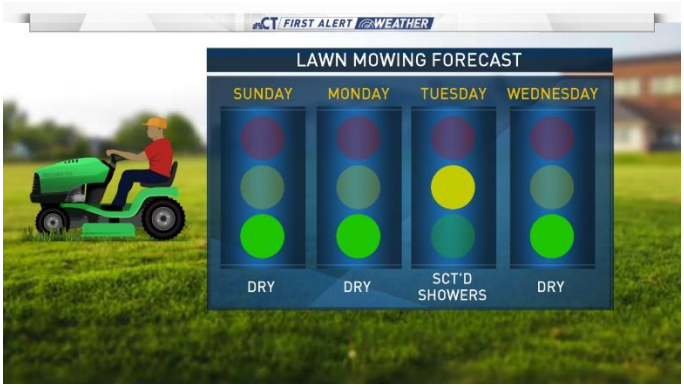

DEW POINT FORECAST
NEXT 7 DAYS
REFRESHING
MODERATE
HUMID
OPPRESSIVE
47°
66°
70°
71°
52°
51°
51°
MON
TUE
WED
THU
FRI
SAT
SUN

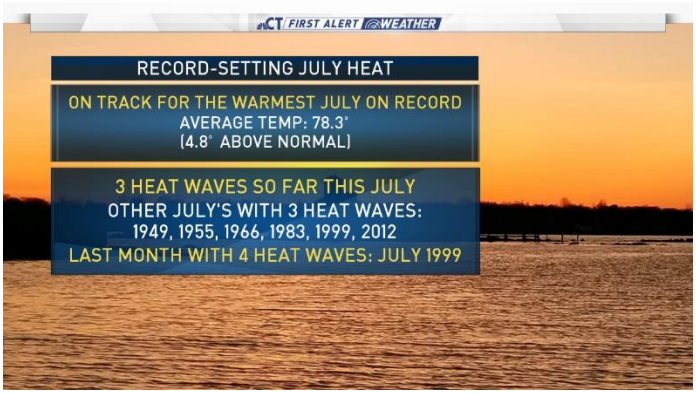

LAST 100° + DAY ACROSS CT
HARTFORD 2016
WINDSOR LOCKS 2012
NEW HAVEN 2011
WILLIMANTIC 2011
NEW LONDON 2010


HEAT INDEX FORECAST
HARTFORD
91°
95°
99°
104°
107°
109°
110°
111°
111°
109°
108°
8AM
9AM
10AM
11AM
NOON
1PM
2PM
3PM
4PM
5PM
6PM


DAYLIGHT TRACKER
SUNRISE
SUNSET
DAYLIGHT
TODAY 5:54 AM 7:56 PM 14 Hrs. 2 Min.
SEPT. 1 6:16 AM 7:24 PM 13 Hrs. 8 Min.
OCT. 1 6:47 AM 6:32 PM 11 Hrs. 45 Min.


PRECIPITATION COVERAGE FORECAST
FRIDAY
SATURDAY
SUNDAY
WASHOUT
WIDESPREAD
SCATTERED
ISOLATED
NO RAIN
WASHOUT
WIDESPREAD
SCATTERED
ISOLATED
NO RAIN
WASHOUT
WIDESPREAD
SCATTERED
ISOLATED
NO RAIN


LAWN MOWING FORECAST
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
DRY
DRY
SCT'D SHOWERS
DRY


RECORD-SETTING JULY HEAT
ON TRACK FOR THE WARMEST JULY ON RECORD
AVERAGE TEMP: 78.3°
(4.8° ABOVE NORMAL)
3 HEAT WAVES SO FAR THIS JULY
OTHER JULY'S WITH 3 HEAT WAVES:
1949, 1955, 1966, 1983, 1999, 2012
LAST MONTH WITH 4 HEAT WAVES: JULY 1999

Link to METEO 300 – August 21 Severe Weather Event

During the final week of my internship, a severe weather event occurred on Wednesday, August 21 which caused several tornado warnings to be issued in Connecticut throughout the evening, and NBC CT was covering the storms on-air non-stop for at least two hours with meteorologists Ryan Hanrahan and Josh Cingranelli. This was a really intriguing and action-packed experience for me as I was helping out behind the scenes during the coverage trying to find images and videos on social media and gathering other information for the meteorologists to use on-air. I got to see all of the moving parts and coordination that needs to happen behind the scenes for wall-to-wall severe weather coverage to be successful.

In the days leading up to August 21, I knew that severe weather was a possibility as some ingredients that are necessary for severe weather were coming together, and on August 20 the Storm Prediction Center had placed all of Connecticut under the "slight risk" category for severe weather (Figure 10). When I came into the station on August 21, both Ryan and Josh let me know what the plan was if severe weather was to happen that evening, and this information was also communicated to the news directors and producers so that everyone was on the same page that day. A warm front crossed the state early in the day on August 21, which put Connecticut in the warm sector of the low-pressure system and allowed temperatures to rise into the mid-80s by the afternoon. The surface analysis from 5pm showed a temperature of 82 degrees Fahrenheit and a dew point of 75 degrees Fahrenheit in Hartford (Figure 2). As we learned in Meteo 300 Lesson 2, warm and humid air is much less dense than cool and dry air. This is because density is inversely proportional to the temperature of an air parcel and directly proportional to the average mass of an air parcel. The warm and unstable air that was in place

across Connecticut on August 21 was able to rise and form thunderstorms that developed that afternoon and evening.

Many of the important ingredients for severe weather can be analyzed on Skew-T soundings that are launched at 12Z (8am EDT) and 00Z (8pm EDT) at most National Weather Service offices across the country. We learned about Skew-T charts in Lessons 2 and 3 of Meteo 300, and this knowledge can be used to analyze the soundings that were launched from the National Weather Service office in Upton, New York on August 21 and 22. One of the primary ingredients for severe weather is a moist layer that is sufficiently deep, since low-level moisture will lower the lifting condensation level (LCL) and the level of free convection (LFC). This will allow parcels to saturate lower in the atmosphere and therefore cool at the moist adiabatic lapse rate sooner. In both the 12Z August 21 and 00Z August 22 soundings, the LCL and LFC are very low (both LCLs are below 900mb and both LFCs are below 850mb), and the temperature and dew point of the atmosphere are very close together all the way up until at least 600mb, suggesting that the atmosphere was loaded with lots of moisture (Figure 4). Another important ingredient for severe weather is convective available potential energy (CAPE), which we learned about in Lesson 3 of Meteo 300. CAPE correlates to the positive area on a sounding between the environment's temperature and the parcel's temperature. When CAPE is present, parcels are positively buoyant and therefore they will rise, leading to more instability in the atmosphere. The magnitude of CAPE is related to the speed of these rising parcels of air, so higher values of CAPE are associated with faster updrafts and generally a better environment for severe weather. The CAPE values on August 21 were not exceptionally high based off the soundings from Upton, New York, with values between 1500 and 1900 Joules per kilogram

(Figure 4). However, the layer where CAPE was present was fairly deep, from about 850mb to 200mb in both the 12Z August 21 and 00Z August 22 soundings, suggesting that air parcels were able to rise very high up in the atmosphere before encountering the equilibrium level (EL) at around 200mb (Figure 4). Finally, vertical wind shear must be present for severe weather to develop, or else downdrafts will interfere with updrafts and significantly weaken a thunderstorm. The 12Z sounding on August 21 from Upton, NY shows that winds were changing somewhat with height, as they were blowing from the south-southwest at the surface and from the west-southwest at around 850mb (Figure 4). All of these weather variables that we analyzed with the Skew-T chart helped to produce the severe weather across Connecticut on the evening of August 21.

The upper-air map for this severe weather event showed that there was a well-defined trough at the 500mb level over the Great Lakes and the Ontario province, with a closed low just south of Hudson Bay at 00Z on August 22 (Figure 3). When this upper-air setup is in place, it usually creates a favorable environment for severe weather in the Northeast, which I learned about during the severe weather workshop that I attended at the beginning of this internship. A low-pressure system developed and strengthened on the eastern side of this upper-level trough due to positive vorticity advection and upper-level divergence over this area. The warm front that passed through Connecticut early in the day on August 21 was associated with this low-pressure system, and the warm frontal passage allowed for convection and severe weather to develop across Connecticut during the evening of August 21.

At around 2pm on August 21, some non-severe thunderstorms already began to develop over parts of central and eastern Connecticut, which usually causes the atmosphere to

become more stable and less favorable for severe weather to develop later in the day (Figure 1). However, this was not the case on this day, as convection and isolated thunderstorms began to develop once again by around 4:55pm over the parts of the state that just saw thunderstorms a couple of hours ago (Figure 1). After the first batch of non-severe thunderstorms, the sun came back out across the state, allowing for increased solar heating which boosted temperatures. Additionally, the atmosphere was already loaded with a lot of moisture due to very high dew points on that day, allowing for this second round of thunderstorms to develop. Between 5 and 6pm, the isolated thunderstorms over central Connecticut began to form into several fairly impressive supercells (Figure 1). These thunderstorms were much more discrete in nature than the first round of thunderstorms earlier in the afternoon, and having discrete supercells is the preferred storm mode for severe weather and tornadoes. Shortly before 6pm, Ryan, Josh, and I noticed some tight rotation developing in one of the thunderstorms over Glastonbury, and right around 6pm a tornado warning was issued by the National Weather Service office in Boston for the southern parts of Hartford and Tolland counties due to this cell (Figures 5 and 6). The station was currently showing commercials as everyone was getting ready for the start of the 6pm newscast, but as soon as possible after the tornado warning was issued, Ryan was on the air with the latest updates. NBC CT was the first of the four news stations in Connecticut to get on the air for this tornado warning, and I think this accomplishment can be attributed to the severe weather plan that everyone knows about at the station. As Ryan tracked this tornado-warned thunderstorm, which had some tight rotation at some points, Josh and I were scouring through social media to find any images or videos that viewers were sending in. It's very important to show viewers any

pictures or videos that do come in, since it shows them the “ground truth” about what’s happening instead of just radar images that they might not understand completely.

As this first area of rotation began to weaken when it was over parts of Coventry and Willimantic at around 6:30pm, a second area of tight rotation began to develop by around 6:45pm over the Connecticut River near Wethersfield and Glastonbury (Figures 6 and 8). A second tornado warning was quickly issued by the National Weather Service office in Boston, and the wall-to-wall severe weather coverage continued on-air (Figure 5). This tight velocity couplet tracked in a path that was fairly similar to the first area of rotation, passing over southern parts of Manchester before weakening over Coventry and Storrs (Figure 6). The rotation that was associated with this cell was stronger than the rotation the first cell exhibited, as seen with the radar-derived shear tracks that I looked at after the event (Figure 9). Even though we were focusing most of our attention on the tornado-warned supercell over southern parts of Hartford and Tolland counties at this time, there were two other areas of rotation in the state that we had to keep our eyes on. By 7pm, a line of strong thunderstorms was moving into the northwest parts of the state which had some broad areas of rotation along the line, but nothing that was too concerning (Figures 1 and 6). Additionally, an area of rotation was present in northeast Connecticut at this time, over parts of Brooklyn and Danielson, which had a severe thunderstorm warning associated with it, but the rotation was not strong enough to issue a tornado warning for this cell (Figure 6). It was really important to keep people updated on these other parts of the state that were experiencing severe weather even though they did not have a tornado warning associated with them, since many viewers were not being affected by the tornado warning in central Connecticut at the time. Additionally, the broad areas of rotation in

the other parts of the state could have tightened up at any point, so looking at these cells behind the scenes on GR2 Analyst was really helpful.

As it got close to 8pm, the tornado warnings had expired and the severe weather threat had significantly diminished across the state (Figure 1). After two hours of wall-to-wall severe weather coverage, NBC CT went back to regularly scheduled programming at around 8pm. There were no confirmed tornadoes from this event, however we did notice lots of damage pictures coming in from Manchester that night. I did a little investigating of the velocity radar data from that evening, and found a strong wind signature (with brighter shades of red, indicating faster winds moving away from the radar site) near exit 3 of I-384 in the southern part of Manchester that was associated with the second area of rotation that evening (Figure 7). This radar velocity signature indicates that there could have been some straight-line wind damage over this area. The next day, Josh and I went out to Manchester to check out the damage and do a live shot for the 5pm newscast. We found a decent number of trees down in the area, which confirmed our initial thought that some strong straight-line winds caused the damage in this part of the state. This was really cool to see how live shots are done and how the graphics that we made on WSI MAX at the station were used to tell the story about the damage on the scene in Manchester. Unfortunately, this was also my last day interning at the station during the summer, but I am glad that I got to experience this severe weather event and see what it was like to be a part of the weather team when wall-to-wall severe weather coverage is happening. I also think that this severe weather event helped me to shape the value of the meteorology degree that I'm working towards and its use in the real world, since the tornado warnings immediately took priority over everything else at the news station and the severe

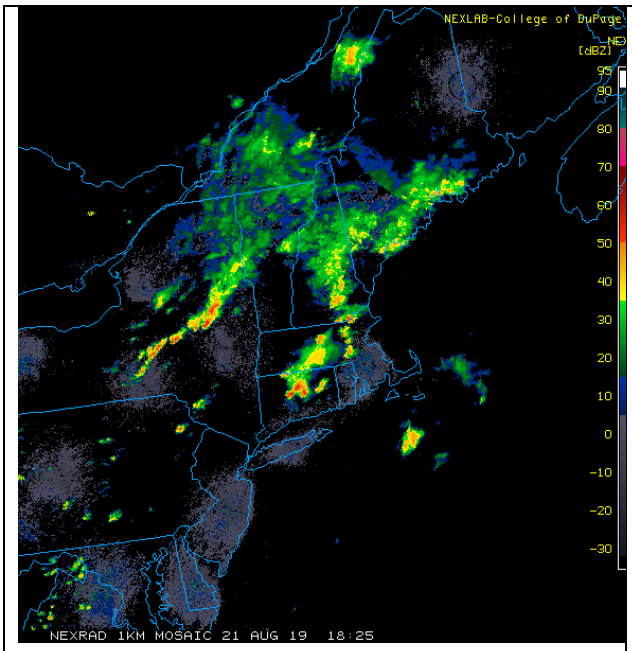
weather coverage took over the 6pm newscast as well as the television programs that were supposed to air up until 8pm. Additionally, I was able to apply things that I learned about at Penn State, in classes like Meteo 300 and synoptic and mesoscale meteorology, to this severe weather event and understand why severe weather was being forecasted and occurring on this date. Overall, I learned a lot about broadcast meteorology and severe weather in general from being at the station during this severe weather event and investigating the damage the day after.

Conclusion

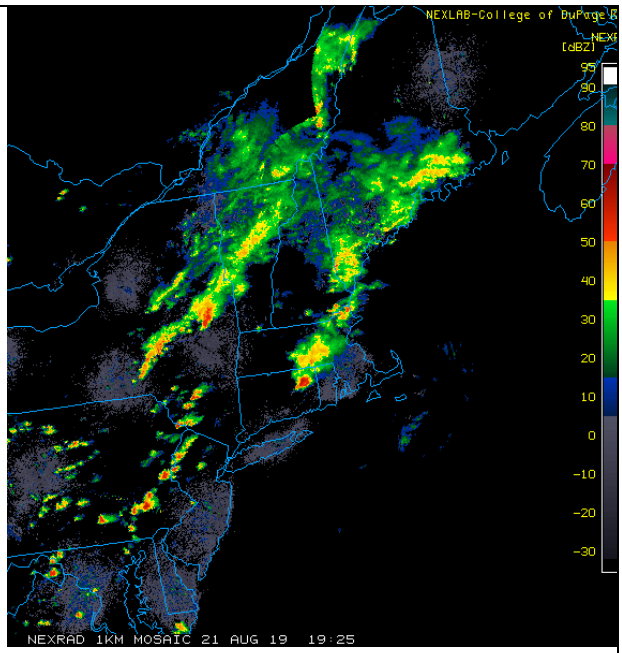
Looking back on this amazing internship experience at NBC CT this past summer, I believe that I learned a lot about the broadcast meteorology profession and I think that it helped me to solidify my career plans after graduation. The overall atmosphere of the station was very welcoming and something that I would love to be a part of for a long period of time as a career after graduation. All of the meteorologists at the station seemed to collaborate and communicate with one another to produce consistent and accurate forecasts, which I think is really important and valuable especially when you have a team of five meteorologists. I also got to be at the station when two meteorologists were there many different times, and this was cool to see the variety of different ways that the second meteorologist was integrated into the newscast with feature stories or coverage from the field. The daily duties that the broadcast meteorologists had to do were all very interesting, and things that I would enjoy doing day after day as a career. But one of my favorite parts of the broadcast meteorology profession is that the weather is constantly changing! This means that each day is going to be slightly different,

especially in the way that you present your forecast to your viewers and tell them a story about the weather for the upcoming days. All of the specific examples that I gave throughout this paper highlight some of the key takeaways that I had from this internship, and the experience as a whole throughout the summer gave me more insight into the daily life of a broadcast meteorologist. Overall, I think that this internship at NBC CT was a very valuable experience that exceeded my expectations and taught me about many different aspects of the broadcast meteorology profession that I will surely use moving forward. I am very thankful for this opportunity that was provided to me by the staff at NBC CT and I look forward to remaining connected in the future with all the great people who work at the station!

FIGURES



2:25pm



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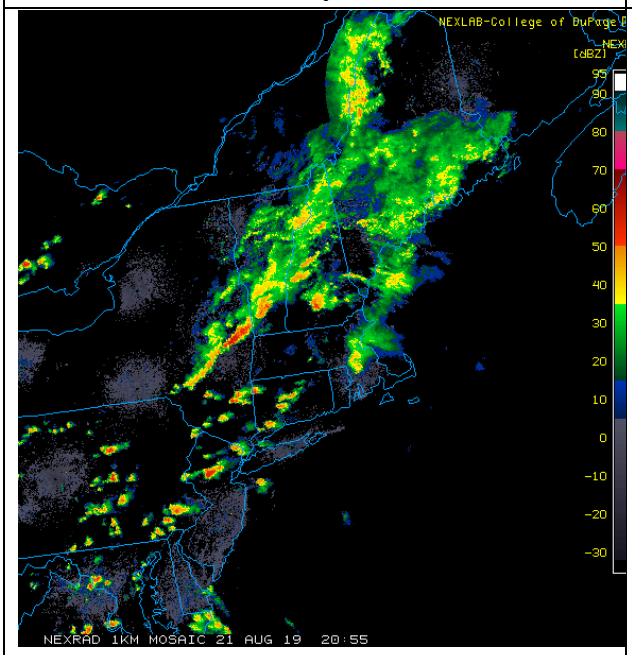
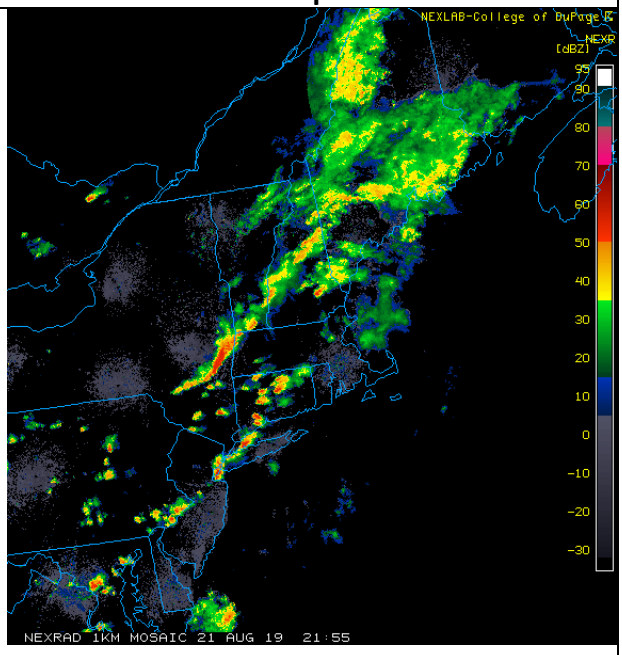


4:55pm



5:55pm

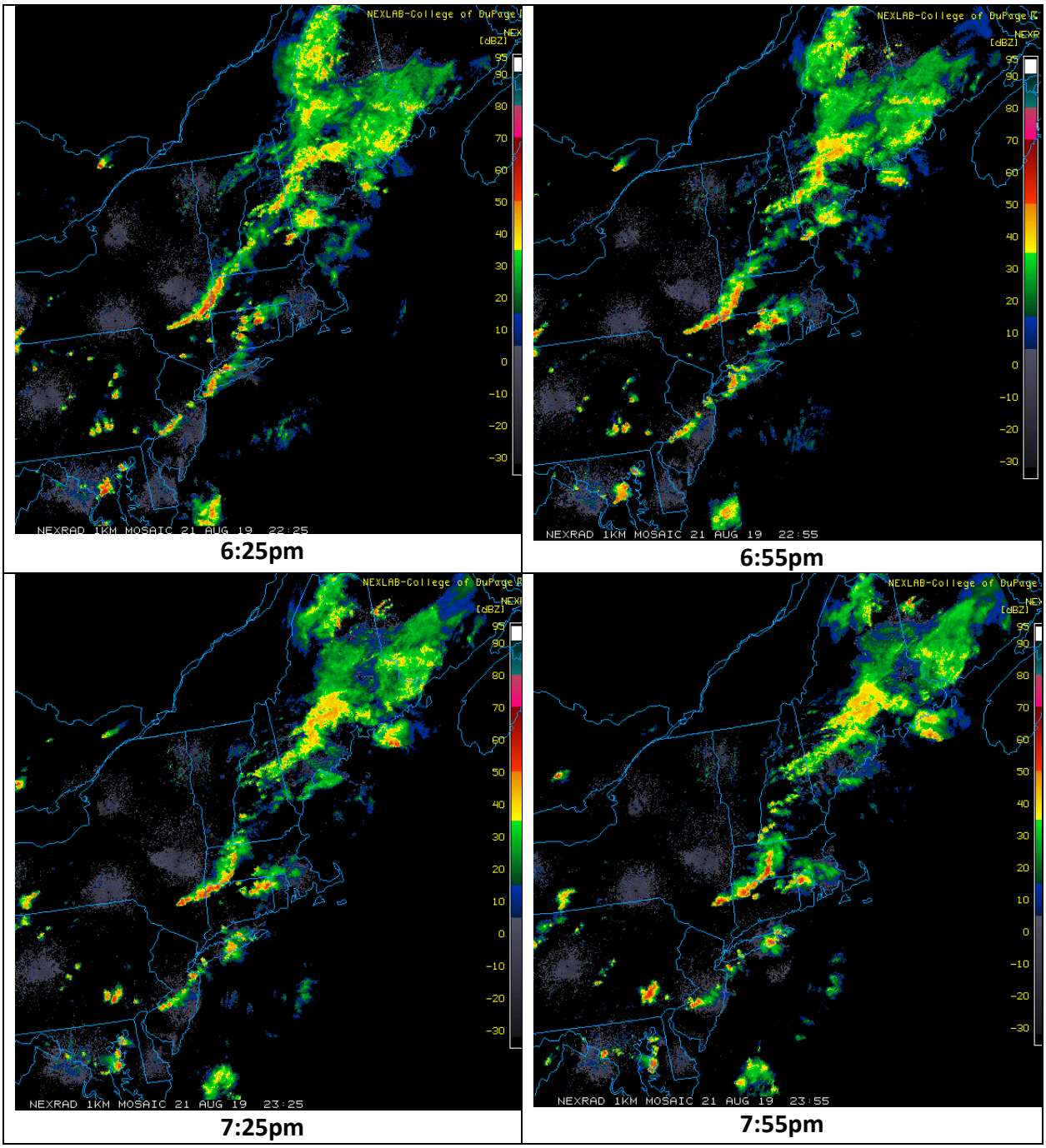


Figure 1: NEXRAD 1km Radar Reflectivity Mosaic for New England from 2:25pm to 7:55pm on August 21, 2019. Images courtesy of University Corporation for Atmospheric Research (UCAR).

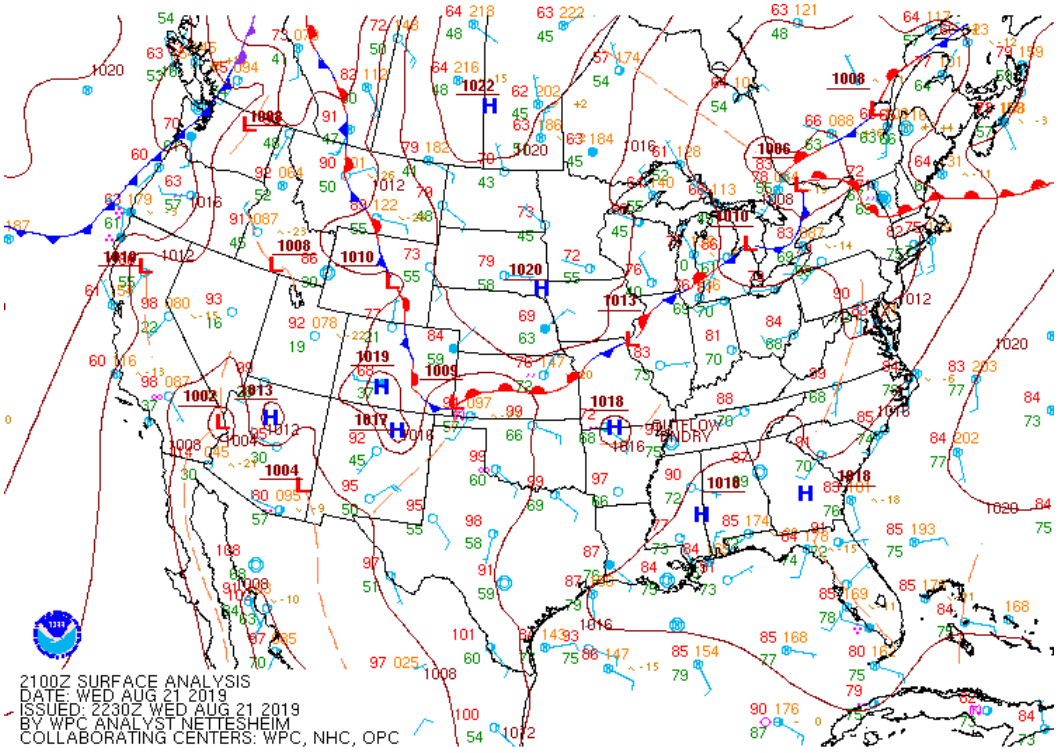


Figure 2: United States Surface Analysis for 5pm (21Z) on August 21, 2019. Map courtesy of the Weather Prediction Center (WPC).

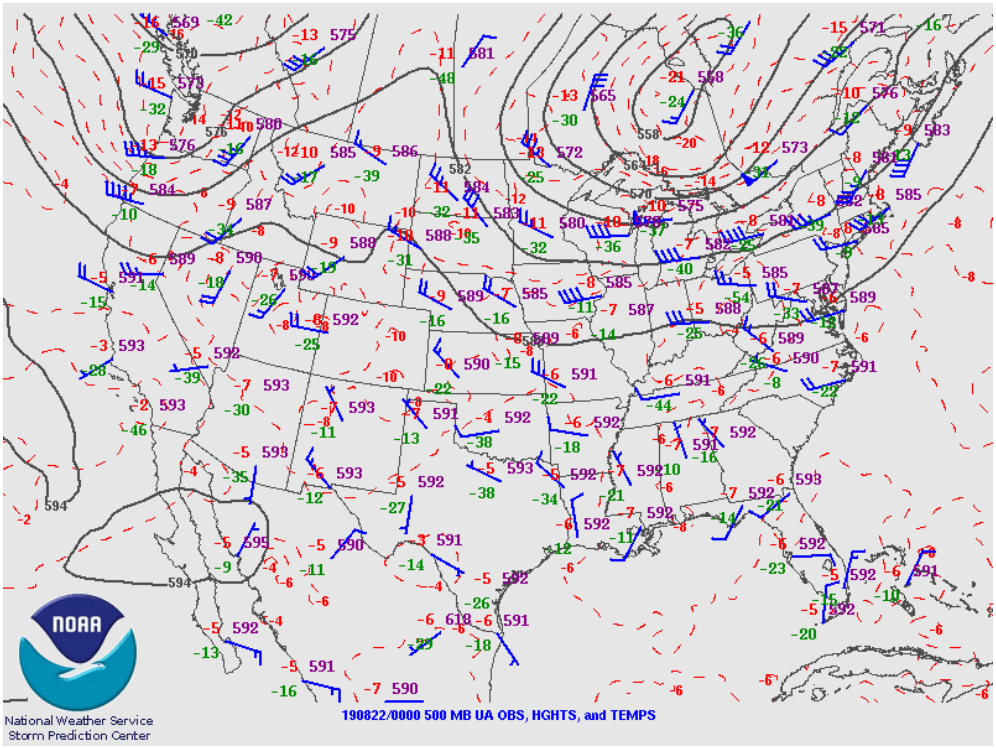


Figure 3: 500mb observations, height contours, and temperature contours at 00Z on August 22, 2019 (8pm on 8/21/19 EDT). Map courtesy of the Storm Prediction Center (SPC).

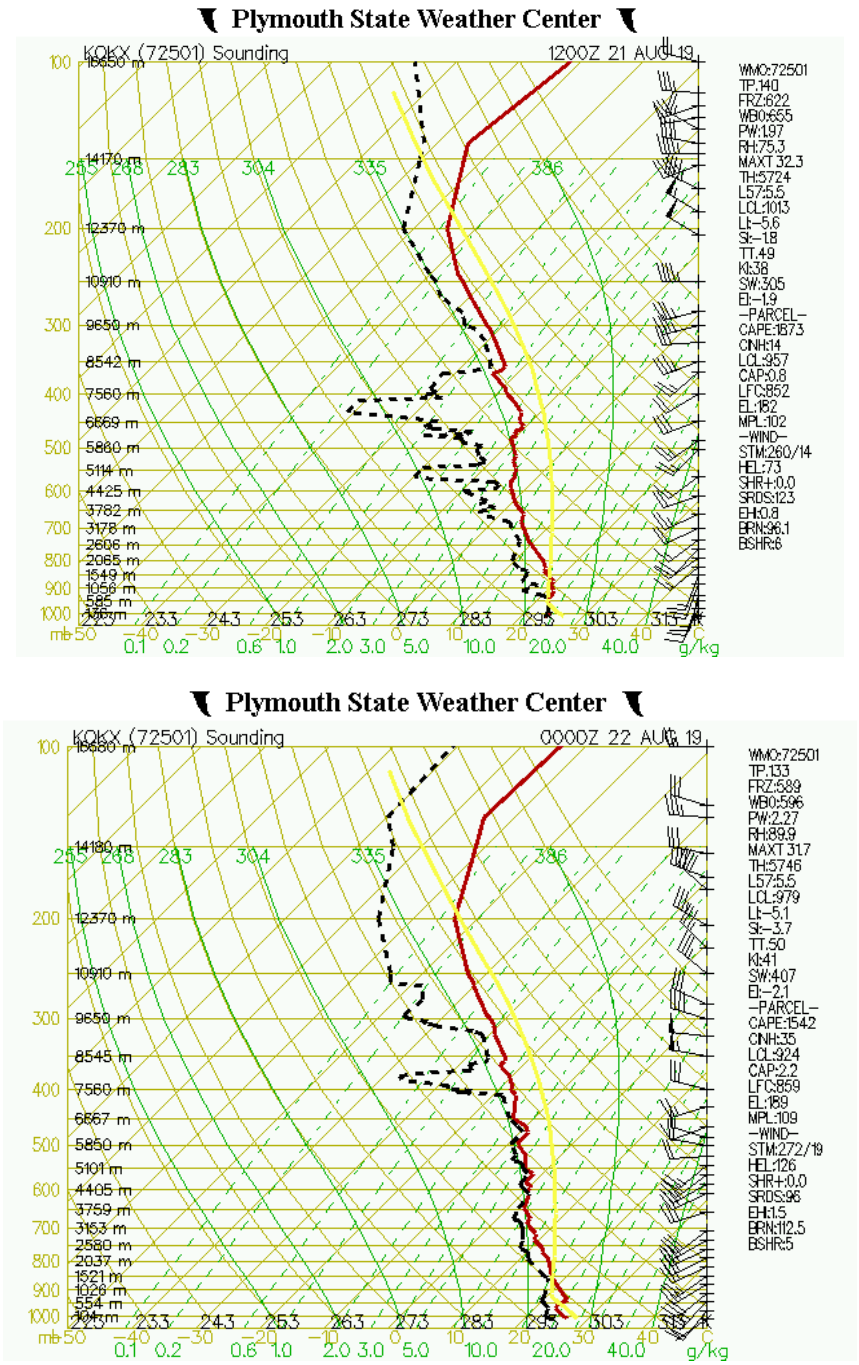


Figure 4: Soundings launched from the National Weather Service office in Upton, NY at 12Z on 8/21/19 (8am EDT) and at 00Z on 8/22/19 (8pm EDT on 8/21/19). Images courtesy of Plymouth State Weather Center.

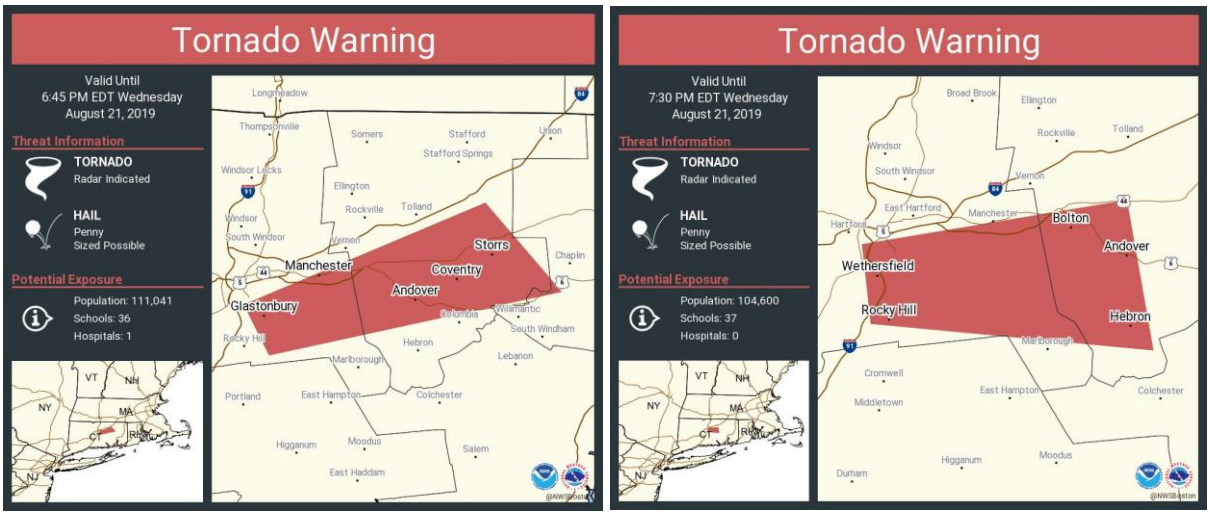
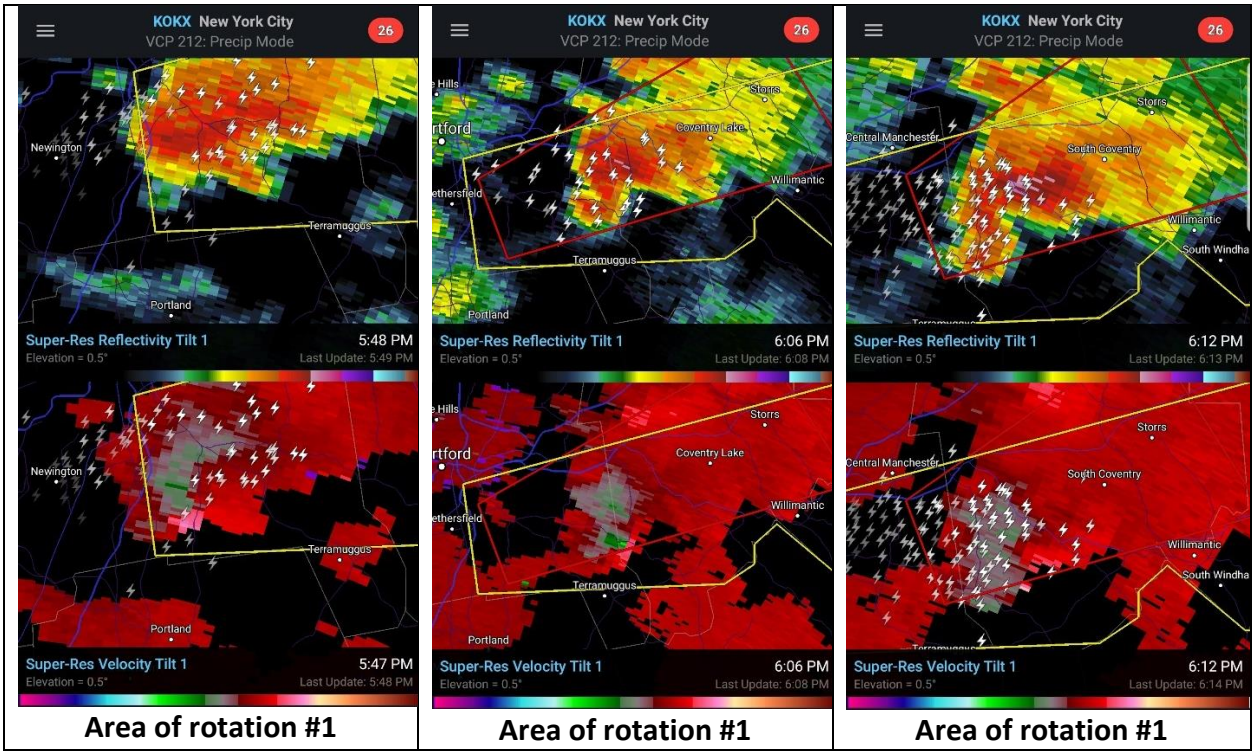
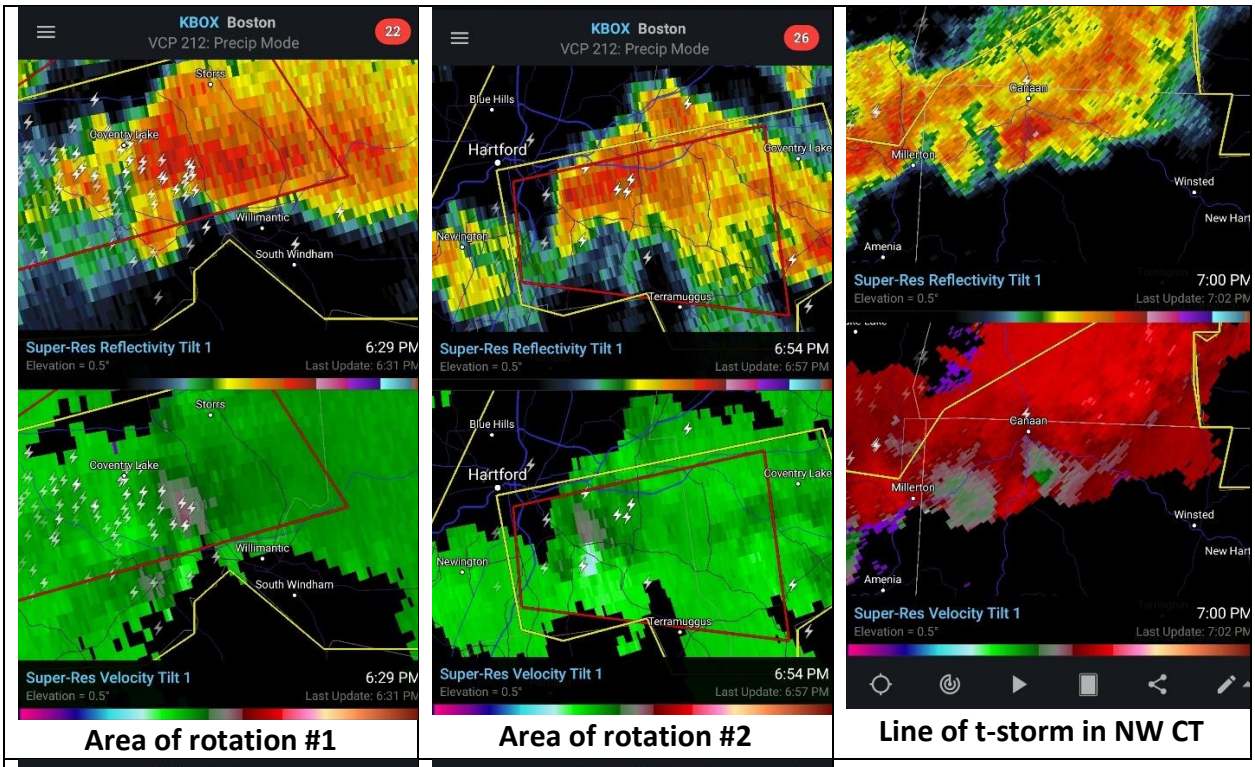


Figure 5: Tornado warnings issued by the National Weather Service's Boston office on August 21, 2019. Images courtesy of NWS Boston.



Area of rotation #1 | **Area of rotation #1** | **Area of rotation #1**



Area of rotation #1 | **Area of rotation #2** | **Line of t-storm in NW CT**

Area of rotation in NE CT | **Area of rotation #2**

Figure 6: Radar reflectivity and velocity images from 5:48pm to 7:09pm on August 21, 2019. Screenshots taken on the RadarScope app.

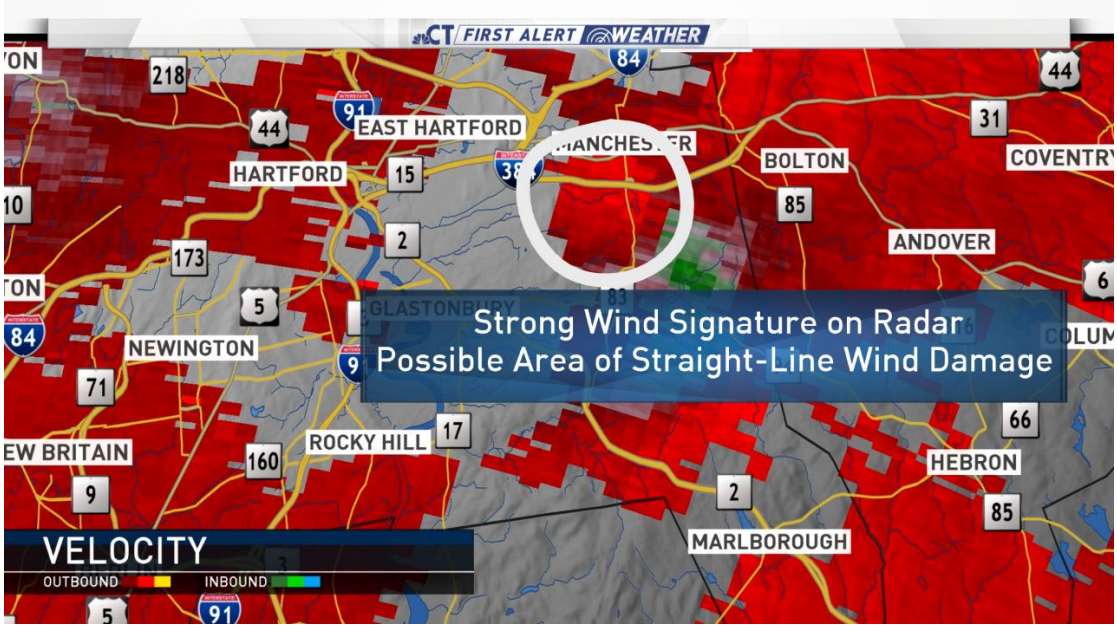


Figure 7: Velocity mode on radar showing a strong wind signature over Manchester, CT on August 21, 2019. Graphic created in WSI MAX.

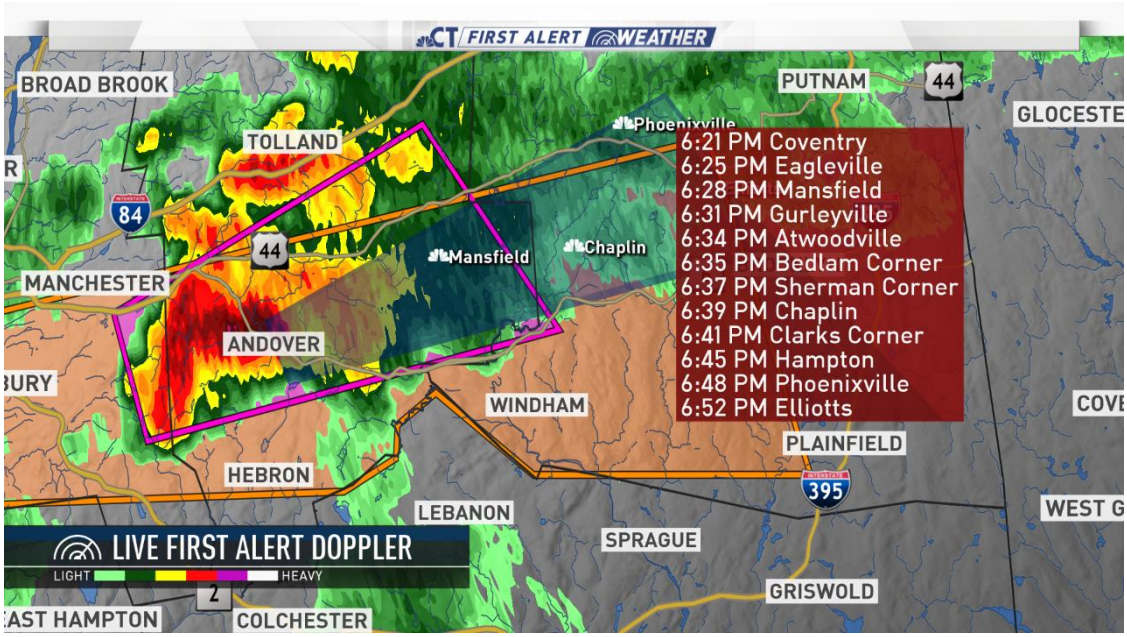


Figure 8: Radar reflectivity showing a strong thunderstorm cell that was part of a tornado warning and a severe thunderstorm warning on August 21, 2019. Graphic from WSI MAX.

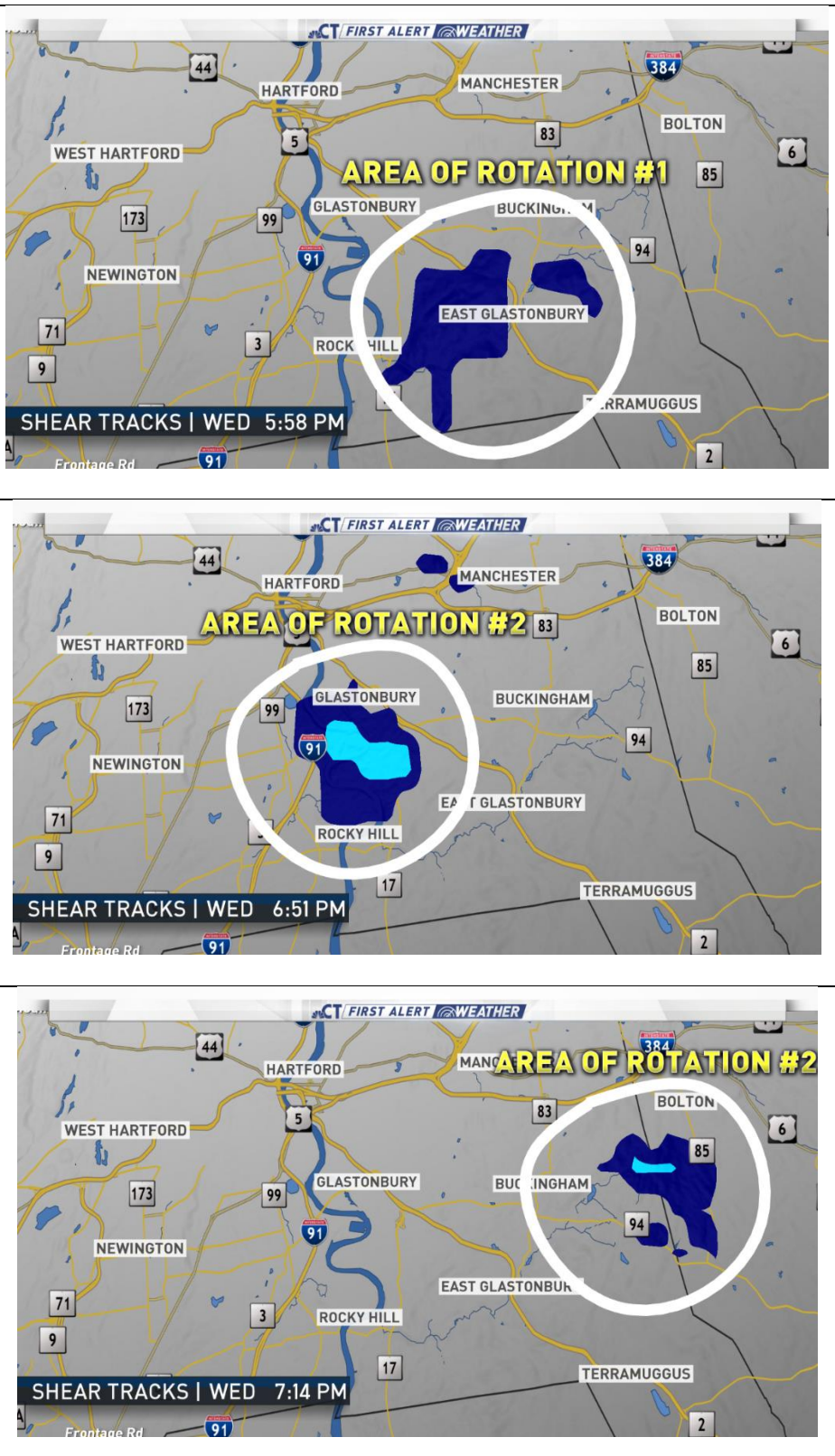


Figure 9: Radar-derived shear from August 21, 2019 which indicates areas of rotation. Graphics created in WSI MAX.

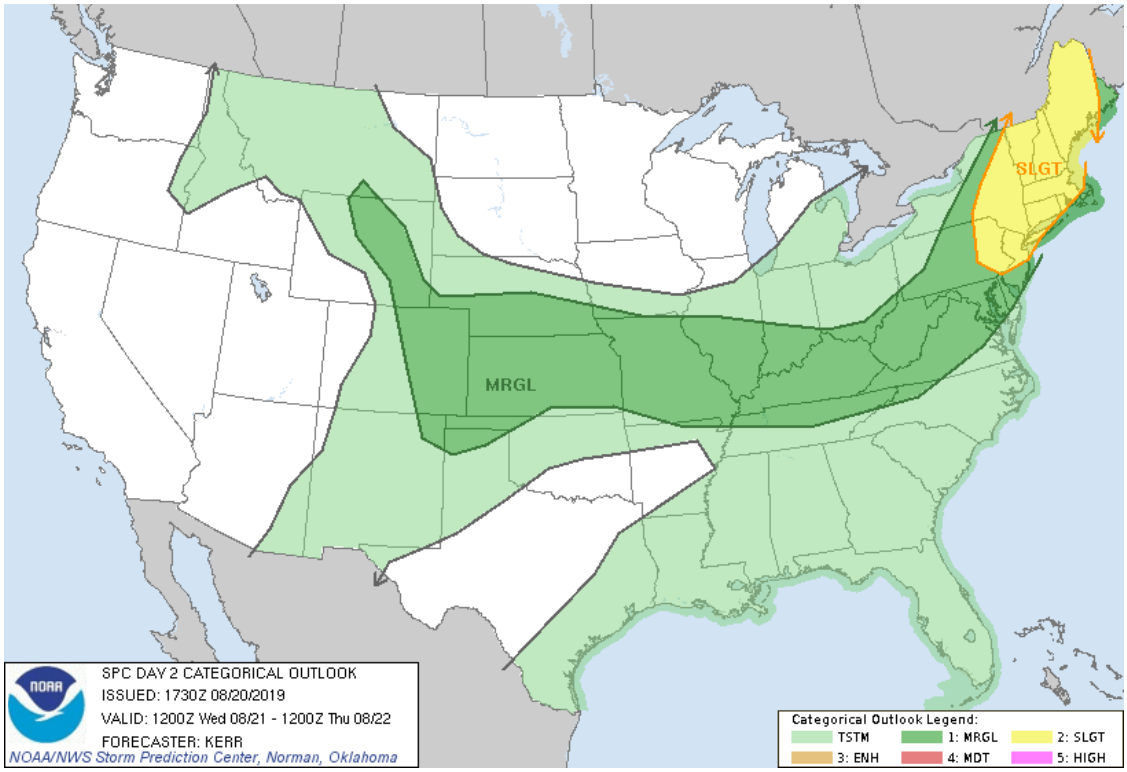


Figure 10: Severe weather categorical outlook for August 21, 2019. Issued at 1730Z (1:30pm EDT) on August 20, 2019. Image courtesy of the Storm Predication Center (SPC).